

in connection with extratropical cyclones, although the Florida tornadoes occurred to the northeast of the cyclone center and those accompanying extratropical cyclones usually occur southeast of the center. In both cases the tornadoes move parallel to the path of the cyclones.

The greatest damage in the Florida Keys seems to have taken place on the northward side of the center—the upper Matecombe Key, the southern portion of Key Largo, and the Cape Sable and Ten Thousand Island areas. On the mainland south of Florida City, about 12 miles of the railway roadbed will have to be replaced. The damage at Key West was confined to the swamping of small fishing boats in the upper harbor, and temporary interruption of lighting and telephone service. A few thousand dollars will cover the loss.

While the wind attained a velocity of about 100 m. p. h. at Everglades and about 75 m. p. h. at Punta Rassa, very little damage has been reported from the southwest Florida coast. However, in Lee county there was an estimated damage of 20 to 30 per cent to oranges and 50 per cent damage to grapefruit. There was no damage of consequence north of Punta Rassa to and

beyond Cedar Keys. In the vicinity of Apalachicola preventable damage due to the storm was comparatively small, but there was considerable damage to property that could not be well protected. The greatest damage occurred when high tides and heavy seas carried away practically every wharf along the water front and damaged all of the fish and oyster houses and canning plants. Some stock in stores in the lower sections was damaged by high water. The high tide and heavy seas did considerable damage to the new Gulf Coast Highway west of Apalachicola. Damage to the business and residential sections was of a minor nature although widespread.

Although the hurricane center passed inland at Panama City, the damage reported was remarkably small for a storm of this character. All wharves and several fish houses were destroyed in the Panama City area and the total monetary damage is estimated at between \$100,000 and \$150,000. At intermediate places between Panama City and Pensacola the damage was small. Satsuma orange groves and pine trees that had been turpentineed in and near the path of the hurricane center suffered considerably. At Pensacola the damage was very small, the total being estimated at about \$60,000.

THE SEPTEMBER 28, 1929, TORNADO IN FORT LAUDERDALE, FLA.¹

551.515 (759)

By GEORGE B. HILLS

Beginning with the afternoon of the 27th of September, a hurricane, which was then nearing the Florida coast, evidenced itself through generally increasing winds and falling barometer. By 4 p. m. of the 28th the wind was blowing from a point south of east at a probable consistent velocity approximating 60 miles per hour and with gusts of greater velocity, temporary decreases, and continuous rain of varying intensity.

At about 4.40 p. m. I was in the back of my mother's house and I noticed that it was suddenly becoming very dark. Within probably two or three minutes the light was so poor that the reading of a newspaper in an inside room would have been difficult. The darkness was accompanied by a rapid and almost complete cessation of all wind.

I called my mother and went with her out onto a screened back porch, which afforded a relatively open view to the southeast, the south, and the southwest. (Her home is located east and slightly south of the main business section of the city.) I immediately saw a low cloud mass in the southeast, black with a golden or yellowish cast, which was approaching rapidly in a northwesterly direction. Within probably a few seconds it had approached to within approximately 600 feet of us and by that time its roar might be compared to the noise of several freight trains being slammed about close at hand. At that point the entire side and roof of a house flew up into the air at least 100 to 125 feet in height and then broke up into small pieces; other debris filled the air, and in a few seconds more the storm had passed on to the northwest and out of sight. Excepting that the flying debris was apparently moving in all directions, no rotating movement was observed. The heavy rains and poor light would have made any such observations difficult. The light quickly returned to normal with the passing of the disturbance.

Later investigations indicated that the disturbance had struck and moved along a path approximately three-quarters of a mile in length, beginning at the outer fringe of the residential section southeast of the business center of the city and moving northwesterly across the business center and through a negro section to the northwest.

The path of the disturbance varied from approximately 150 to 300 feet in width, and within its path it damaged or completely wrecked the frame houses, garages, trees, and other obstacles that it encountered. At the stormward side of the business section of the city it struck the exposed rear of a 4-story reinforced concrete and tile hotel from which it ripped the greater portion of the flat roof and the parapet walls above the top floor level. I saw two pieces of debris which I would judge weighed from 100 to 125 pounds, and which were identified as having come from the hotel structure, lying from 300 to 500 feet farther along the storm path.

Across the street from the hotel the storm struck fairly against a 10-story reinforced concrete office building, where the damage was limited to the breaking out of the large majority of glass windows on the east or stormward side. Apparently rising up over the building, the storm again struck the ground a few hundred feet beyond, completely blowing away all excepting the floor of the Railway Express Co. office and loading platform alongside the Florida East Coast Railway tracks. Two trunks and a dog belonging to a friend of mine, which were in the express company office at the time, had not been located the following day.

Continuing for perhaps a quarter of a mile before it apparently rose and disappeared, the storm destroyed most of a 2-story store building above the level of the second floor, and seriously damaged or destroyed a large storage warehouse and lumber yard, mill-working establishment, and several lightly built negro houses.

The entire damage along the path of the storm probably occurred within a minute's time and represented the only damage incurred in the city during the entire period of the hurricane.

¹ Scattered evidence has come to hand at various times that seems to indicate the occurrence of tornado storms within well developed tropical cyclones. The editor is glad, therefore, to be able to present first-hand evidence of the occurrence of a tornado within a fully developed tropical cyclone. The tornado did not have the destructive violence that is associated with storms of like character in the interior of the continent, and its direction of movement, although contrary to that of most tornadoes, was in the same direction as that of the tropical cyclone.—EDITOR.

The outer limit of the tornado's path was sharply defined. A typical example was found in the instance of a house which we own, the corner of which was located 18 feet from the corner of a similarly constructed adjoining house. Our house was completely undamaged, while the adjacent house was completely destroyed.

Another example was found in the instance of a lightly built cottage with a slightly supported open porch, located immediately across the street from the lumber yard and mill-working establishment referred to above. While the latter was very badly damaged, the flimsy cottage across the street was not harmed in any way.

The captain of a large dredge anchored at Port Everglades, a few miles southeast of Fort Lauderdale, advised me that the tornado in coming in from the ocean passed between his dredge and a large barge anchored some 400 feet to the north without striking either. He advised me that he saw no evidence of a waterspout in connection with the tornado.

Mr. E. A. Pynchon, a civil engineer and shipyard owner of Fort Lauderdale, was watching a recording barometer in Flippen's hardware store when the storm center passed within some 300 or 400 feet of that building. He states that the needle dropped abruptly nine points, quivered at the low point for a few moments, and then

rose abruptly to the original reading. The graph record indicated a vertical line drop and rise of five points.

The passing of the tornado apparently marked the peak and end of the hurricane disturbance at Fort Lauderdale. Within 30 minutes after its passing a decrease in the intensity of the hurricane winds was definitely noticeable, and within two hours the wind velocity was probably down to 30 miles an hour or less. Thunder and lightning had developed in the east by that time, and the storm decreased continuously thereafter. The recording barometer indicated a steadily increasing pressure after the passage of the tornado.

ADDITIONAL EVIDENCE

Following is an excerpt from the report of the cooperative observer at Fort Lauderdale:

I did not see the tornado, but heard the noise, but as the hurricane was causing so much noise did not notice that of the tornado. My daughters were sitting in the bedroom on northeast side of the house, and came running to the porch and wanted to know what the air was filled with that was going past on the north side of my house. Some who saw the tornado speak of it as a "ball of fire." The tornado went through the city bouncing like a ball; places in its path would not be touched, then it would strike some building and tear it into pieces.

THE STATUS OF CLIMATOLOGY OF THE AGES

557.583

By MARSDEN MANSON

Physical facts are the language of Nature and every expression uttered by her is worthy of our most attentive consideration—MAURY.

When the climatologist turns from his volumes of observed data to the climatic records made by natural processes he enters one of the most interesting and important fields of his science.

He can not climb a mountain in any latitude to an altitude at which glaciers yet rest without finding evidences of their retreat and of the corresponding advance of forest growth. It makes no difference where these observations be made, whether in reaching the feeble remnants of glaciers in the Sierra Nevadas, the Alps, the Himalayas, or upon Ruenzori, Chimborazo, the greater glaciers of Alaska or Patagonia, or the vast ice sheets in polar latitudes, the records are the same—*continuous retreat*. Possibly fluctuating slightly, but everywhere the integrals of successive retreats are far greater than those of advances.

Retracing his steps he can observe what may have escaped his notice at first, that the glaciers once extended to lower and lower slopes, until, in temperate latitudes, they reached the bases of the mountains and left morainic soils on which grapes, olives, and oranges now flourish, or in tropical and equatorial latitudes the evidence of glaciation are buried in dense forests only a few thousand feet above sea level.

Should his studies be broadly conducted he can trace these evidences of deglaciation across a continent and to the north of these limits vast glacial lake beds now producing abundant crops of wheat and oats.

In this he enters the enticing fields of paleo-climatology. In these he is called upon by the geologist to explain the evidences of a series of alternations between severe and destructive glaciation and the geniality of the insolation in latitude, or the warm and cold interglacial epochs of Pleistocene glaciation; and the transition of the last of these warm epochs into existing conditions and the principles of physics involved in this transition.

All of his observations establish a distribution of temperatures entirely different from those of to-day, and contradicting every principle of modern climatology. He will be forced to the conclusion that the retreat he has so clearly traced, and observed as yet in progress, reveals the closing chapters of a distinct transition from the conditions and control of paleo-climates into those of modern climates.

Neither branch of his science, as at present taught, gives in any particular the reasons for this change or transition between the two distinctly different and contradictory climatic records, nor why, when, where, and how modern climates began and paleo-climates ended, or of the causes of the stages in this transition. Nor again to the naturally suggested question, to what conditions do the progress and control, evidently inaugurated at some indefinable period and in some undetermined regions, now lead? He is irresistably led into the interpretation of these enticing and unmistakable records which are contrary to the distributions of modern climates, contradict them by glaciations in all latitudes which could not occur under the accepted constancy of direct solar radiation, nor do they yield to any assumption of variation in solar radiation, for they are utterly incongruous to such direct control as solar energy can impose on a planetary surface inclosed in air and having water within its control; contradicts them by the glaciations of temperate latitudes extending into polar latitudes, while tropical latitudes at or near sea level continued to enjoy the geniality of their insolation; contradicts them by the most severe and destructive glaciation recorded at sea level in tropical latitudes during Perno-Carboniferous time, coincident with subpolar and polar geniality with no sign of glaciation. These considerations lead us into paleo-climatology and into the period or periods and the latitude or latitudes in which the